THE

AMERICAN NATURALIST.

Vol. IX.—MAY, 1875.—No. 5.

THE LAW OF EMBRYONIC DEVELOPMENT THE SAME IN PLANTS AS IN ANIMALS.

BY I. A. LAPHAM, LL.D.

It is a well known law in the animal kingdon, that the young or embryonic state of the higher orders of animals, resemble the full-grown animals of the lower orders. As examples, we have the tadpole, which is a young frog with gills and a tail, thus resembling the fishes which stand lower in the scale than the reptiles; and the caterpillar which has the characters of a worm, but is the immature state of the butterfly, an animal of a higher class of articulates. The discovery of this important law, and its application to particular cases, has been one of the causes of the recent rapid progress in the study of the animal kingdom; it has enabled naturalists to determine the proper place of certain species in the grand scale of beings, and thus to correct their systems of classification; it has enabled geologists to decide upon the relative age of rocks, in some otherwise doubtful cases.

It is the purpose of this paper, to show, as briefly as possible, that the same law of resemblance between the immature of one order and the mature of a lower order of animals, is equally true in the vegetable kingdom, where its study may hereafter lead to equally important results.

Plants grow from seed planted in the ground, have roots, stem, branches, leaves; they produce flowers with calyx and corolla, and the more essential organs, stamens and pistils; they bear fruit

with seed after their kind, which when planted, swell and become plants again.

The stamens have at their top a sack (the anther) completely filled with grains nicely packed, each of which proves on examination to be a small sack (Fig. 115, the pollen) filled with a viscous fluid matter, in which are floating exceedingly small grains called fovilla. These are essential organs in the reproduction of the plant, and must perform their functions before the seed can be matured. We may increase and multiply plants by layers, cuttings and budding; but to reproduce a new plant, the agency of the stamen, pollen and fovilla, is needed as well as that of the seed.

Fig. 115. Pollen.

Under a good microscope, this fovilla may be seen in any ripe pollen grains, but the particles are among the most minute things we are called upon to examine; requiring the higher powers of the instrument even to see them; and, what is truly wonderful, these minute particles are found to have a proper motion of their own. They move forward, backward or sidewise, but never make much progress in any direction; the motion appears to be objectless, not like that of an animal seeking its food. The cause of this motion is not known; it is called molecular motion, and may be the effect of some chemical action; but is more probably due to the mysterious vital force.

From the bottom of ponds of stagnant water, and from springy places, we may bring up plants so minute that no unaided human eye has ever seen them; they consist of a single cell; they are the smallest and the very lowest grade of plant-life, the Desmideæ; and yet they are full-grown plants. They never grow to be anything else, they are only Desmideæ and nothing more. They are true plants and not animals, as was once supposed.

These minute, though full-grown plants, will be found actively moving forward and backward and sidewise; making no progress; appearing to have no aim, no object; precisely like the little particles of fovilla from the pollen grains, of the highest orders of plants.

Here then we have the first proof of the existence of the law in the vegetable kingdom; the wonderful motion, both of the full-grown plant of the lowest of the vegetable race, and of the particles, which may be regarded as one of the first steps toward the reproduction of plants of the highest type.

Arctic and Alpine travellers report the snow as sometimes red, and we know that our stagnant waters are sometimes green; these colors are found upon close examination to be owing to other minute one-celled plants called Protococcus (Fig. 116). They are little sacks or cells containing particles of a brilliant carmine-red, or beautiful green color. Each particle within the cell is destined to become a new plant, and then again to give origin to others.

Fig. 116.

Protococcus.

The analogy between these full-grown plants of an exceedingly low grade and the pollen-grains (Fig. 115) of a rose, standing at or near the head of the plant kingdom, is at once apparent. They contain particles (fovilla) destined to the same office of reproduction; one woodcut serves to represent both.

The Botrydium (Fig. 117) may be deemed a plant only a little higher in the scale than the Protococcus. It consists like that of a single cell, but this cell sends down a tube which is often branched, extending off in various directions very much like roots in search of vegetable food. The cell proper is filled as usual with the reproductive particles; and some of the branches become enlarged as shown in the figure, develop other particles and soon separate to form new plants of the same kind.

Fig. 117.

Botrydium.

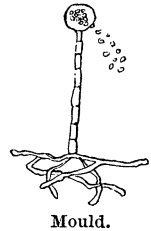
In this, and in many similar full-grown plants of the lower orders, there is a very striking correspondence with the pollen grains after they have fallen upon the stigma and developed tubes, the pollen-tubes (Fig. 118). In both cases we have a cell with a tube extending downwards from one side, with the vegetable particles and fovilla, and in both, these minute bodies are supposed to pass down the tube to perform their office of originating a new plant.

Fig. 118.

Pollen tube.

Here again the full-grown Botrydium corresponds with the embryonic pollen-tubes of the higher plants; and we have a third proof of the existence of the law.

Fig. 119.



Mould.

Fungi are plants of a higher grade than the Algæ, the Protococcus, and the Botrydium. Instead of a single cell, they consist of an aggregation of cells; and they produce a number of little cases or sacks filled with grains, called spores. Here (Fig. 119)

is the figure of the mould that grows upon bread in a damp cellar. It consists of a single stem made up of cells placed one upon the other, and a single globular spore-case at the top. The spores are liberated when ripe and are blown to the four quarters of the world by the wind. Wherever they alight, circumstances being favorable,—as bread in a damp cellar,—they grow and become mould again. Compare this, which is one of the lowest of the Fungi, with a stamen (Fig. 120) growing in one of the most perfect of flowers. It has its filament (stem) supporting a case or sack (the anther) filled with pollen-grains (which I compare with the spores of the fungi) and which, when fully mature are liberated and scattered about by the wind, or are carried by insects. Under favorable circumstances (falling upon the stigma) they also grow and become new plants.

Fig. 120.

Stamen.

These examples are sufficient for the present purpose; they show clearly the existence of this important law in the vegetable, as well as in the animal kingdom. Many similar analogies might be found throughout the whole course of vegetable life, were it desirable to pursue the subject. We have here one more link between the two great kingdoms of organized nature, and another proof of the unity of design of the Creator.

ON THE PHYSICAL AND GEOLOGICAL CHARACTERISTICS OF THE GREAT DISMAL SWAMP, AND THE EASTERN COUNTIES OF VIRGINIA.

BY PROF. N. B. WEBSTER.

This remarkable morass, situated partly in Virginia and partly in North Carolina, is about forty miles long and from fifteen to twenty-five miles wide. The earliest account of a passage through the swamp is by Col. Byrd, who surveyed the state boundary line in 1728. Until this time, Col. Byrd wrote in his journal "this dreadful swamp was ever judged impassable."

About 1755 a Scotchman named Drummond, discovered the pond now bearing his name, and which has since been immortalized by Moore as the "Lake of the Dismal Swamp."